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11

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A-78

## LEFT-TURN LANES

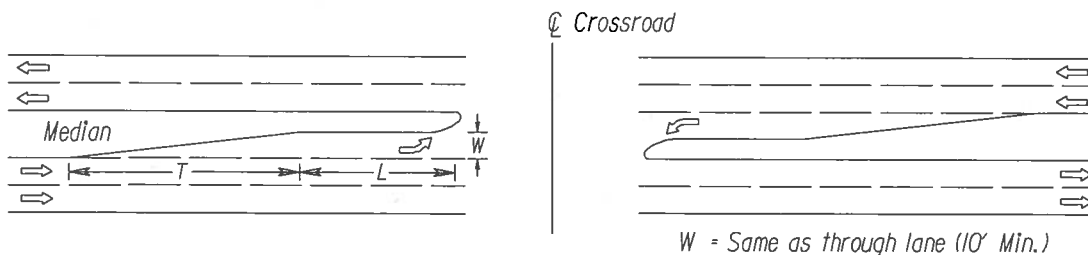
As a general policy, left-turn lanes are to be provided for traffic in both directions in the design of all median crossovers on non-access controlled divided highways using controls as shown in Figure C-1-1. Left-turn lanes should also be established on two-lane highways where needed for storage of left-turn vehicles and/or prevention of thru-traffic delay.

LENGTH OF STORAGE	
Rural - For Design Speeds 50 MPH or Higher	*L - 200' min. (For 240 or fewer vehicles during peak hour, making turn)
- For Design Speeds Less than 50 MPH	*L - 100' min. (For 60 or fewer vehicles during peak hour, making turn)
*Distance L to be adjusted upward as determined by capacity analysis for Left-Turn Storage.	
Urban - Length determined by capacity analysis for Left- Turn Storage	
TAPER - Rural and Urban	
- For Design Speeds 35 MPH or Higher	**T - 200' Min.
- For Design Speeds Less than 35 MPH	**T - 100' Min.
**Tapers are to be straight- line unless local policy requires reverse curves. In congested areas the taper length may be reduced to increase storage length.	

**FIGURE C-1-1**

Dimension "L" to be adjusted upward as determined by Figure C-1-1.1 or by capacity analysis for left-turn storage.

A capacity analysis is defined as a detailed analysis of the location in accordance with the guidelines contained in the current issue of the Highway Capacity Manual for intersection capacity and signalization requirements.



## GEOMETRIC DESIGN STANDARDS FOR RURAL PRINCIPAL ARTERIAL SYSTEM (GS-1)

	TERRAIN	DESIGN SPEED (MPH)	MINIMUM RADIUS	(6)(7) STOPPING SIGHT DISTANCE		MIN. WIDTH OF LANE	(1) MINIMUM WIDTH OF GRADED SHOULDER		(2) PAVED SHOULDER WIDTH		(3) WIDTH OF DITCH (FRONT SLOPE)	(4) SLOPE	(5) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES
				Desirable	Min.		FILL	CUT	RT.	LT.			
FREEWAYS	LEVEL	70	1821	850'	730'	12'	15'	12'	10'	4'	12'	CS-4B	2 THRU LANES SAME DIRECTION = 6' + PAVE. WIDTH + 12' 3 OR MORE THRU LANES SAME DIRECTION = 12' + PAVE. WIDTH + 12'
	ROLLING	60	1204	650'	570'							CS-4E	
	MOUNTAINOUS	50	780	475'	425'							CS-4E	
OTHER PRINCIPAL ARTERIALS	LEVEL	70	1821	850'	730'	12'	13'	10'	8'	4'	10'	CS-4 OR 4B	UNDIVIDED & DIVIDED 3 OR MORE THRU LANES SAME DIRECTION = 10' + PAVE. WIDTH + 10'
		60	1204	650'	570'							CS-4 OR 4E	
	ROLLING	60	1204	650'	570'						6'	CS-4 OR 4E	DIVIDED 2 THRU LANES SAME DIRECTION 6' + PAVE. WIDTH + 10'
		50	780	475'	425'							CS-4 OR 4E	
	MOUNTAINOUS	50	780	475'	425'							CS-3 OR 3B	
		40	465	325'	305'							CS-3 OR 3B	

### GENERAL NOTES

**Freeways** - A design speed of 70 mph should be used for Rural Freeways. Where terrain is mountainous a design speed of 60 mph or 50 mph, which is consistent with driver expectancy, may be used. All new and major reconstructed Interstate facilities will have a 70 mph design speed unless a lower design speed is approved by the Location and Design Engineer and FHWA.

**Other Principal Arterials** - A design speed of 40 to 70 mph should be used depending on terrain, driver expectancy and whether the design is constructed on new location or reconstruction of an existing facility. An important safety consideration in the selection of one of the lower design speeds in each range is to have a properly posted speed limit which is enforced during off peak hours.

Incorporated towns or other built-up areas, Urban Standard GS-5 may be used for design.

Standard **TC-5.01R** superelevation based on 8% maximum is to be used for all Rural Principal Arterials.

RELATIONSHIP OF MAXIMUM GRADES TO DESIGN SPEEDS								
TYPE OF TERRAIN	FREEWAYS			ARTERIALS				
	DESIGN SPEED (MPH)							
	50	60	70	40	50	60	70	
	GRADES (PERCENT) *							
	LEVEL	4	3	3	5	4	3	3
ROLLING	5	4	4	6	5	4	4	
MOUNTAINOUS	6	6	5	8	7	6	5	

Clear Zone and Recoverable Area information can be found in Appendix A, Section A-2 of the Road Design Manual.

If medians are included, see Section 2D-6 of Chapter 2D of the Road Design Manual.

### FOOTNOTES

- (1) Shoulder widths shown are for right shoulders and independently graded median shoulders. An 8' graded median shoulder will be provided when the mainline is 4 lanes (both directions). For 6 or more lanes, the median shoulder provided will be the same as that shown for independent grading.
- (2) When the mainline is 6 or more lanes, the left paved shoulder width should be the same as the right paved shoulder. On Freeways, if truck traffic exceeds 250 DDHV, the right paved shoulder width preferably should be 12', and on 6 or more lane Freeways, the left paved shoulder width should also preferably be 12' if truck traffic exceeds 250 DDHV.
- (3) Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width.
- (4) Additional or modified slope criteria to apply where shown on typical sections.
- (5) Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 16'-6" (1' additional clearance required for non-vehicular overpasses).
- (6) For intersection sight distance requirements see Appendix C, Table C-1-5.
- (7) Use desirable value as minimum on Interstate system.

FIGURE A - 1 - 1

GEOMETRIC DESIGN STANDARDS FOR RURAL MINOR ARTERIAL SYSTEM (GS-2)

TRAFFIC VOLUME	TERRAIN	DESIGN SPEED (MPH)	MIN. RADIUS	(8) STOPPING SIGHT DISTANCE		MINIMUM PASSING SIGHT DISTANCE	(2) MIN. WIDTH OF LANE	(3) MIN. WIDTH OF GRADED SHOULDERS		(4) PAVED SHOULDER WIDTH		(5) WIDTH OF DITCH (FRONT SLOPE)	(6) SLOPE	(7) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES
				Desirable	Min.			FILL W/GR	CUT & FILL	RT	LT			
(1) ADT OVER 2000	LEVEL	70	1821	850'	730'	2500'	12'	13'	10'	8'	4'	10'	CS-4, CS-4A OR CS-4C	10' PLUS PAVEMENT WIDTH PLUS 10'
		60	1204	650'	570'	2150'								
	ROLLING	60	1204	650'	570'	2150'								
		50	760	475'	425'	1850'								
	MOUNTAINOUS	50	760	475'	425'	1850'								
		40	465	325'	305'	1500'								
(1) ADT 1500 TO 2000	LEVEL	70	1821	850'	730'	2500'	12'	11'	8'	6'	4'	6'	CS-4, CS-4A OR CS-4C	8' PLUS PAVEMENT WIDTH PLUS 8'
		60	1204	650'	570'	2150'								
	ROLLING	60	1204	650'	570'	2150'								
		50	760	475'	425'	1850'								
	MOUNTAINOUS	50	760	475'	425'	1850'								
		40	465	325'	305'	1500'								
ADT 400 TO 1500	LEVEL	70	1821	850'	730'	2500'	12'	11'	8'	6'	4'	6'	CS-4, CS-4A OR CS-4C	6' PLUS PAVEMENT WIDTH PLUS 6'
		60	1204	650'	570'	2150'								
	ROLLING	60	1204	650'	570'	2150'								
		50	760	475'	425'	1850'								
	MOUNTAINOUS	50	760	475'	425'	1850'								
		40	465	325'	305'	1500'								
ADT UNDER 400	LEVEL	70	1821	850'	730'	2500'	12'	9'	6'	4'	4'	6'	CS-4, CS-4A OR CS-4C	6' PLUS PAVEMENT WIDTH PLUS 6'
		60	1204	650'	570'	2150'								
	ROLLING	60	1204	650'	570'	2150'								
		50	760	475'	425'	1850'								
	MOUNTAINOUS	50	760	475'	425'	1850'								
		40	465	325'	305'	1500'								

GENERAL NOTES

Rural Minor Arterials are designed with design speeds of 50 to 70 MPH, dependent on terrain features and traffic volumes, and occasionally may be as low as 40 MPH in mountainous terrain.

In incorporated towns or other built-up areas, Urban Standard GS-6 may be used for design.

Standard IC-501R superelevation based on 8% maximum is to be used for Rural Minor Collectors. If medians are included, see Section 2D of the Road Design Manual.

Clear zone and Recoverable Area information can be found in Appendix A, Section A-2 of the Road Design Manual.

RELATIONSHIP OF MAXIMUM GRADES TO DESIGN SPEEDS				
TYPE OF TERRAIN	DESIGN SPEED (MPH)			
	40	50	60	70
	GRADES (PERCENT)			
LEVEL	5	4	3	3
ROLLING	6	5	4	4
MOUNTAINOUS	8	7	6	5

FOOTNOTES

- (1) Use current ADT for restoration type projects and use design year ADT for all other projects.
- (2) Lane width to be 12' at all interchange locations. For projects not on the National Highway System, width of traveled way may remain at 22' on reconstructed highways where alignment and safety records are satisfactory.
- (3) If graded median is used, the width of median shoulder is to be 8'.
- (4) The Paved widths shown are the widths to be used if the Materials Division recommends the shoulders be paved. When the mainline is 4 lanes (both directions) a minimum 8' wide paved shoulder will be provided on the right of traffic and a minimum 4' wide paved shoulder on the median side. Where the mainline is 6 or more lanes, both right and median paved shoulders will be 8' in width. If paved shoulders are not recommended by the Materials Division the mainline pavement structure will be extended 1' at the same slope into the shoulder to eliminate raveling of the pavement edge.
- (5) Ditch slopes to be 6:1 - 10' width, 4:1 - 6' width.
- (6) Additional or modified slope criteria to be applied where shown on typical sections.
- (7) Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 16'-6" (1' additional clearance required for non-vehicular overpasses).
- (8) For intersection sight distance requirements see Appendix C, Table C-1-5.

FIGURE A - 1 - 2

A-81